

CLAIMS

What is claimed is:

1. A power delivery device for providing an electrical signal in an electrochemical process involving an object, the power delivery device comprising:

5 a power stage having an input and an output, the input for receiving a power signal, the output being operably connected to the object;

a sensor being operably connected to the output;

a controller being operably connected to the output and responsive to the sensor;

and,

10 a modulator being operably connected between the controller and the power stage wherein the power stage outputs the electrical signal to the object in response to the modulator and the controller.

2. The power delivery device of Claim 1 wherein the electrical signal includes an AC ripple component and a DC component.

3. The power delivery device of Claim 1 wherein the electrical signal includes a dynamic power, the dynamic power being operably responsive to the specific features of the object.

4. The power delivery device of Claim 1 further comprising a user interface being operably connected to the controller.

5. The power delivery device of Claim 1 wherein the controller is a digital signal processor having an A/D converter and a D/A converter.

6. The power delivery device of Claim 1 wherein the modulator is a pulse width modulator.

5 7. The power delivery device of Claim 1 wherein the modulator is a frequency modulator.

8. The power delivery device of Claim 1 wherein the sensor is a current sensor.

10 9. The power delivery device of Claim 1 wherein the sensor is a voltage sensor.

10. The power delivery device of Claim 1 wherein the sensor is a power sensor.

15 11. The power delivery device of Claim 1 wherein the electrical signal output by the power stage includes a constant power.

12. The power delivery device of Claim 1 wherein the electrical signal output by the power stage includes a power gradient waveform.

20 13. The power delivery device of Claim 1 wherein the electrical signal output by the power stage includes a voltage gradient waveform.

14. The power delivery device of Claim 1 wherein the electrical signal output by the power stage includes a current gradient waveform.

25 15. The power delivery device of Claim 1 wherein the electrical signal output by the power stage includes a frequency gradient waveform.

16. The power delivery device of Claim 1 wherein the electrical signal output by the power stage includes a uni-polar waveform.

17. The power delivery device of Claim 1 wherein the electrical signal output by the power stage includes a bi-polar waveform.

18. The power delivery device of Claim 1 wherein the electrical signal output by the power stage has a dynamic power, the dynamic power being operably responsive to the specific features of the object.

19. The power delivery device of Claim 18 wherein the electrical signal further being operably responsive to a process condition.

20. A power delivery device for providing an electrical signal for an electrochemical process wherein an object is operably connected to the power delivery device, the power delivery device comprising:

a tracking power stage being operably connected to the object;

an output power stage providing the electrical signal having an AC component and a DC component to the object, the output power stage being operably responsive to the tracking power stage wherein a dynamic power dissipated by the output power stage is minimized.

21. The power delivery device of Claim 20 wherein the tracking power stage comprises:

a controller being operably connected to the output power stage, the controller having a reference parameter input wherein the controller provides an input signal to the output power stage in response to the reference parameter and the electrical signal.

22. The power delivery device of Claim 21 wherein the reference parameter input is a voltage.

5 23. The power delivery device of Claim 22 wherein the reference parameter input is a current.

24. The power delivery device of Claim 21 wherein the reference parameter input is power.

10 25. The power delivery device of Claim 21 further comprising:
a frequency modulator being operably connected to the controller and the object,
the frequency modulator having a first input being operably connected to the output
power stage and a second input being operably connected to a ripple reference for an AC
signal parameter wherein the controller is operably responsive to the output of the
15 frequency modulator.

26. The power delivery device of Claim 25 wherein the ripple reference is approximately equal to or greater than 10KHz.

20 27. The power delivery device of Claim 25 wherein the ripple reference is approximately equal to or less than 1MHz.

28. A method of providing power to a plating process for plating an object, the
method comprising the steps of:
25 providing an electrical signal to the object, the electrical signal comprising an AC
component and a DC component;
sensing a parameter of the electrical signal; and,

adjusting the AC component of the electrical signal in response to the sensed parameter.

29. The method of Claim 28 further comprising:

5 adjusting the DC component of the electric signal in response to the sensed parameter.

30. The method of Claim 28 wherein the sensed parameter is current.

10 31. The method of Claim 28 wherein the sensed parameter is voltage.

32. The method of Claim 28 wherein the sensed parameter is power.

15 33. The method of Claim 28 wherein the electrical signal provided to the object includes a constant power.

34. The method of Claim 28 wherein the electrical signal provided to the object includes a power gradient waveform.

20 35. The method of Claim 28 wherein the electrical signal provided to the object includes a frequency gradient waveform.

36. The method of Claim 28 wherein the electrical signal provided to the object includes a uni-polar waveform.

25

37. The method of Claim 28 wherein the electrical signal provided to the object includes a bi-polar waveform.

38. The method of Claim 28 wherein the electrical signal provided to the object includes a dynamic power, the dynamic power being operably responsive to the specific features of the object.

5 39. The method of Claim 28 wherein the electrical signal being operably responsive to a process condition.

40. The method of Claim 38 wherein the electrical signal further being operably responsive to a process condition.

11/20/2019 10:00 AM